J Raptor Res. 36(2):91–96

AN URBAN OSPREY POPULATION ESTABLISHED BY TRANSLOCATION

MARK S. MARTELL[1]
The Raptor Center at the University of Minnesota, 1920 Fitch Avenue, St. Paul, MN 55108 U.S.A.

JUDY VOIGT ENGLUND
Hennepin Parks, 3800 Co. Rd. 24, Maple Plain, MN 55359 U.S.A.

HARRISON B. TORDOFF
Bell Museum of Natural History and Department of Ecology, Evolution, and Behavior, University of Minnesota, St. Paul, MN 55108 U.S.A.

ABSTRACT.—We evaluated the success of an Osprey (*Pandion haliaetus*) translocation program which released, by hacking, 143 juveniles into the Minneapolis-St. Paul, Minnesota area from 1984–95. All of the released, and 80% of 194 wild-fledged birds, were banded and color-marked as nestlings. The first nesting attempt occurred in 1986 and the first successful nest was in 1988. By the end of the 2000 nesting season, we had documented 131 nesting attempts, 90 (69%) of which were successful. The greatest number of occupied sites in any year (19) was in 2000, while the most productive sites documented in any year (13) was in 1999. From 1987–2000, 194 wild-fledged chicks were produced in the Twin Cities area. Mean number of young fledged per occupied nest during this period was 1.57 (range = 0–2.3) and mean number of young fledged per successful nest was 2.17 (range = 1–2.7). Overall nest success was 69% with a small number of sites and individuals responsible for a disproportionate number of fledglings. Released birds were more likely to return to nest than wild-fledged birds, and more males than females returned to nest. Mean female dispersal distance (384 km) was greater than that of males (27 km). We conclude that this translocation was successful and with proper management this population will remain stable or continue to grow.

KEY WORDS: *Osprey*; Pandion haliaetus; *productivity*; *translocation*; *urban wildlife*; *Minnesota.*

Una poblacion urbana de aguilas pescadoras establecidas su traslado

RESUMEN.—Evaluamos el exito de un programa del traslado de águilas pescadoras (*Pandion haliaetus*) el cual liberó, 143 juveniles dentro de Minneapolis-St. Paul, área de Minnesota de 1984–95. Todos los liberados, y 80% de las 194 aves volantonas, fueron anilladas y marcadas con color cuando eran polluelos. El primer intento de anidación ocurrió en 1986 y el primer nido exitoso fue en 1988. Para el final de la temporada de anidación del 2000, hemos documentado 131 intentos de anidación, 90 (69%) de los cuales tuvieron éxito. El numero mas grande de sitios ocupados en cualquier año (19) fue en el 2000, mientras que la mayoría de sitios productivos documentados en cualquier año (13) fue en 1999. De 1987–2000, 194 polluelos emplumados en vida silvestre fueron producidos en l área de las ciudades gemelas. El numero promedio de juveniles emplumados por nido ocupado durante este periodo fue 1.57 (rango = 0–2.3) y el numero promedio de juveniles emplumados por nido exitoso fue 2.17 (rango = 1–2.7). En conjunto el éxito de anidación fue 69% con un pequeño numero de sitios e individuos responsables de un numero desproporcionado de volantones. Las aves liberadas probablemente retornaron mas al nido que las aves emplumadas en vida silvestre, y retornaron al nido mas machos que hembras. La distancia media de dispersión de las hembras (384 km) fue mas grande que la de los machos (27 km). Concluimos que este traslado fue exitos y con un manejo adecuado esta población permanecerá estable continuara creciendo.

[Traducción de César Márquez]

Translocation, the movement of eggs, young, or adults from a wild population to a new location, has become a widely used conservation management tool for many species of wildlife. Recently, Cade (2000) reviewed 52 translocation projects involving 25 species of diurnal birds of prey. Osprey

[1] E-mail address: marte006@umn.edu

(*Pandion haliaetus*) translocations have been successful in Pennsylvania (Rymon 1989), Tennessee (Hammer and Hatcher 1983), and North Carolina (R. Bierregaard pers. comm.). Currently, Osprey translocations are ongoing in the United Kingdom (H. Dixon and R. Dennis pers. comm.), Missouri, Ohio, Colorado, and Iowa U.S.A. The success of translocations is often evaluated by the number of released animals and their offspring that establish a self-sustaining population (Griffith et al. 1989, Cade 2000). In long-lived species like the Osprey, reproductive effort and population stability, important factors in determining success, can take many years to measure. Maintaining the support and interest necessary to monitor these parameters over time can be more difficult than the initial translocation effort.

In Minnesota, Ospreys historically nested in the east-central portion of the state (Roberts 1932), which now includes the Minneapolis-St. Paul urban area. By 1900, this population had disappeared due to persecution and loss of suitable nest sites (Roberts 1932, Gillette and Voigt Englund 1985, Coffin and Pfannmuller 1988). Although Ospreys continued nesting in northern Minnesota even through the DDT era in the mid-1900s, there was no nesting recorded in the southern part of the state, partially due to the species' reluctance to colonize new areas (Poole 1989). In 1984, a program to restore a nesting population of Ospreys in the Twin Cities area was initiated (Gillette and Voigt Englund 1985). The effort focused on hacking translocated nestlings from northern Minnesota and erecting artificial nest platforms (Martell et al. 1994, Martell 1995). Using techniques similar to those employed in Tennessee (Hammer and Hatcher 1983) and Pennsylvania (Rymon 1989), we released 143 translocated Osprey nestlings at eight sites in the Twin Cities area from 1984–95. Here, we examine the characteristics of this new urban population established by translocation.

METHODS

The study area included a seven-county region in east-central Minnesota centered around the cities of Minneapolis and St. Paul, here referred to as the Twin Cities. From 1984–2000 we banded all 143 released nestlings, and 156 of 194 wild-fledged chicks (80%) from the study area. Ospreys released in the first 3 yr of the program (35 birds) were banded with a standard aluminum U.S. Fish and Wildlife Service (USFWS) band that was anodized blue (1984) or gold (1985–86). Ospreys released after 1986, and all wild-fledged young, were banded with a silver USFWS band and a black, lock-on, aluminum, alphanumeric coded-color band. We also banded and color-marked six nesting adults. More than 30 nest platforms were erected in the area, some under our direction, others independently.

Previously-occupied nest sites and other nesting platforms were visited several times annually, and reports of other Osprey nesting activity in the area were checked. We monitored nest sites throughout the breeding season to determine occupancy (defined as the presence of an adult pair), and productivity (number of young at banding), and to identify nesting adults where possible. We calculated annual survival through 74 territorial years defined as: "the record of one territorial adult from one breeding season to the next" (Tordoff and Redig 1997) Dispersal distances between fledging and first-time nest sites were calculated by mapping sites using a Global Positioning System (GPS) receiver, then entering coordinates and calculating straight-line distances on ArcView Geographic Information System (GIS) (Environmental Systems Research Institute, Inc. [ESRI], Redlands, CA) Statistical tests were done using Statistix 7 (Analytical Software, Tallahassee, FL).

RESULTS

Nesting and Productivity. The first nesting attempt occurred in 1986 by a translocated male and two unbanded females less than 3 km from where the male was released in 1984. Although eggs were laid, no young were produced. In 1987, after eggs again failed to hatch, a translocated chick was placed in that nest resulting in the first parent-raised Osprey fledgling in the Twin Cities area since the late 1800s. The number of territories and production of young increased in the following years (Fig. 1) so that by the end of the 2000 nesting season we documented 131 nesting attempts, 90 (69%) of which were successful. The highest number of occupied sites in any year (19) was in 2000, whereas the greatest number of productive sites in any year (13) was in 1999 (Fig. 1).

We calculated the change in the number of nesting pairs (lambda) for the years 1986–2000 and found the change to be one or higher for all years except one (1996). We used a simple regression of the log of lambda against the number of pairs and found a density dependent decrease ($F = 2.82$, $P = 0.1192$, df = 13) over time, consistent with the growth of a new population.

A total of 194 wild-fledged chicks were produced in the Twin Cities area from 1987–2000, in addition to the 108 chicks released during that time (35 were released from 1984–86) (Fig. 1). During this period the number of wild young fledged per occupied nest was 1.57 (yearly range = 0–2.3) and the number of young fledged per successful nest was 2.17 (yearly range = 1.00–2.7).

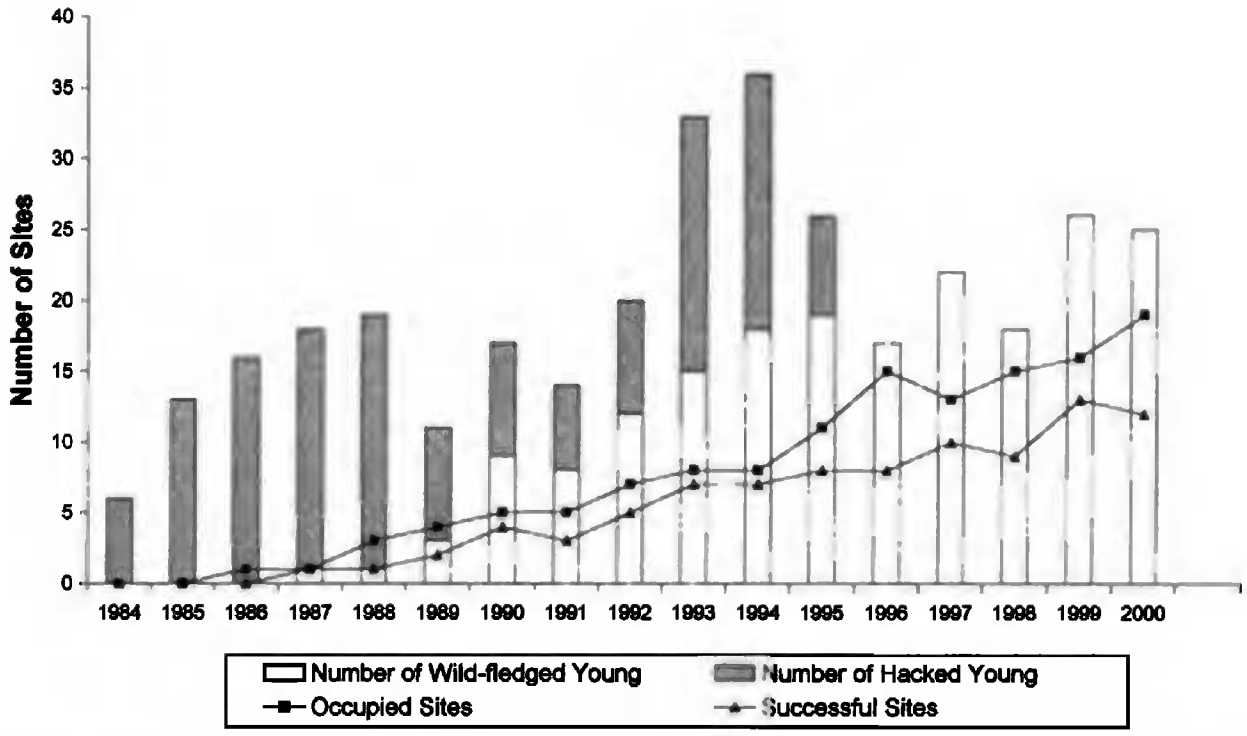

Figure 1. Number of hacked young, number of occupied sites, successful sites, and wild young Ospreys produced in the Twin Cities, Minnesota area, 1986–2000.

Individual Site Characteristics. From 1986–2000 nesting was attempted at 26 sites, 20 (77%) of which produced young. Fourteen sites (54%) were initiated in the last 5 yr of the study; nine were productive (45% of the productive sites). Only two sites have been occupied continuously since 1988. Adults at four sites produced young successfully every year since they became occupied (8, 6, 3, and 2 yr). Three productive nests (15%) were abandoned and not occupied in subsequent years. One site was abandoned after 2 yr of successful nesting due to usurpation of the nest by Great-horned Owls (*Bubo virginianus*), forcing the pair to move 2.5 km to a nearby nest where they have fledged young successfully for the past 3 yr.

Of 20 productive nests, 13 (65%) were in a park or protected park-like habitat, four (20%) were in backyards of private residences, and three (15%) were in industrial areas. All but three of the nests that Ospreys attempted to use were on platforms erected for them; the only non-platform site where young were produced successfully was a nest built by Ospreys on the top of a water tower. The other two non-platform nests were built on power transmission poles and destroyed by lightning or removed by the utility company.

Five sites accounted for 48% of the young produced and four of seven local second-generation breeders. Four of these sites are among the oldest in the study area, having been occupied since at least 1992. Three sites are within 4.5 km of each other in Carver Park Reserve and produced 32% of the wild-fledged young during this period.

Fidelity, Dispersal, and Nesting Age. We were able to identify at least one adult at 21 (81%) nest sites, representing 94 (72%) nesting attempts. We identified 23 marked individuals (16 released, 7 wild; 2 females, 21 males) nesting in the area from 1986–2000. Additionally, five female Ospreys banded as nestlings in the Twin Cities (four released, one wild) were reported nesting outside the study area in Dickinson County, Iowa (P. Schlarbaum pers. comm.); Benzie County, Michigan (S. Postupalsky pers. comm.); Cook County, Illinois (S. Fejt pers. comm.); Stark County, Ohio (S. Peters pers. comm.); and Crow Wing County, Minnesota (M. Martell pers. observ.). The Minnesota female was nesting in the same county from which she was translocated.

Released birds (20 of 143) seemed more likely to return to the study area to nest than wild-fledged Ospreys (8 of 125) through 1997, although this pattern was not significant ($\chi^2 = 3.35$, df = 1, $P = 0.0674$). Released birds were also responsible for more nesting attempts (62% of total) than banded wild-fledged birds (13% of total). Twenty-five percent of nesting attempts involved no locally banded birds.

Differences in natal dispersal distances (log-transformed) were not affected by whether they were released or wild ($F_{1,24} = 2.02$, $P = 0.17$), but were significantly different by sex ($F_{1,24} = 16.48$, P

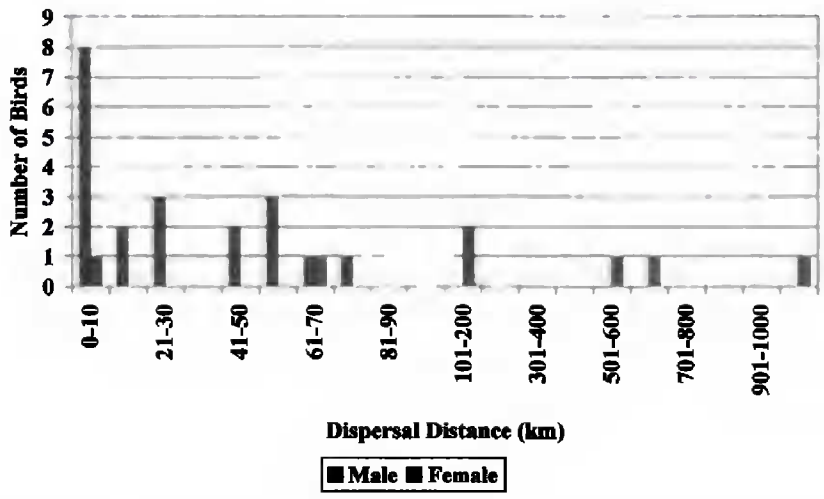

Figure 2. Natal-dispersal distance of male and female Ospreys fledged in the Twin Cities, Minnesota, 1986–2000.

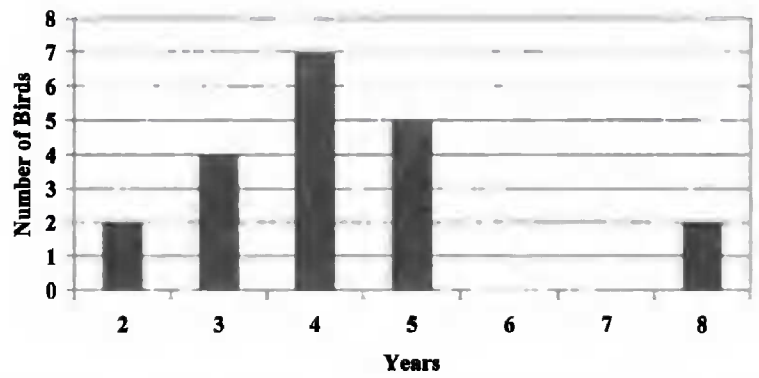

Figure 3. Age at first nesting for male Ospreys in the Twin Cities, Minnesota, 1986–2000.

= 0.0005). Females dispersed a mean distance of 384 km (SE = 146, N = 7, range = 8–1075 km) from their fledge site, significantly farther than the males (N = 20), whose mean dispersal distance was 27 km (SE = 5.5, N = 20, range = 1–65 km; Fig. 2).

Median age of males at first known nesting was 4 yr, and varied from 2–8 yr (Fig. 3). In 2000, the median age of all marked Ospreys nesting in the Twin Cities was 8 yr. Using territorial years (Tordoff and Redig 1997), we calculated the annual survival rate of marked territorial males as 91%. The oldest banded Osprey nesting in the Twin Cities was a male released in 1984 and was still nesting in 2000 at age 16. The oldest female recorded was a released bird who was 10-yr old in 2000.

Band Returns. Seven band returns from outside the study area have been reported, four from released birds, three from wild birds. All returns involved juveniles, presumably on their wintering grounds, from Colombia, Costa Rica, Ecuador, Panama (2), and Peru (2).

DISCUSSION

Translocations are considered successful if they result in "a self-sustaining population" (Griffith et al. 1989). Population viability analysis and other modeling techniques can be used to determine success objectively, although more often subjective criteria are used (Cade 2000). We believe that this translocation effort was successful, at least in the near term, as indicated by the continued growth of the local population, high reproductive rates, and the longevity of individuals coupled with the return of breeding second-generation birds.

Productivity in the Twin Cities population ($\bar{x}$ = 1.57 young/occupied nest) is above the 0.9–1.3 young/occupied nest necessary for population stability (Henny and Wight 1969), and at the high end of the range for North American Ospreys (Poole 1989). While many factors influence productivity, in our study population the use of artificial nest platforms, which have been shown to increase nesting success (Seymour and Bancroft 1983, Westall 1983), seems important.

Early dependence on a small number of highly-productive individuals and sites is probably to be expected in a translocated population of this size. Studies of established populations of Ospreys and other raptors show that a small number of pairs usually are disproportionately responsible for producing successive generations (Poole 1989, Postupalsky 1989). Breeding success in Ospreys has been shown to be positively affected by experience and by retention of mates from one year to the next (Poole 1989); similarly, our most productive sites were among the oldest and had little or no turnover of males (females were not marked and thus their turnover rate was not known).

The greater number of released birds returning to the study area to breed when compared to wild-fledged young is an interesting, and unexpected, feature of this new population. We expected that juveniles raised by their parents with no human interference would be better equipped to survive to breeding age. Two possible explanations for the greater representation of released birds occur to us. First, the released birds were able to return to an area devoid of competition for prime nest sites. As the translocated population increased, their offspring may have been forced into less desirable sites because of local competition. The second possibility is that, contrary to expectations, released birds may have had a higher survival rate during their first year. Released Peregrine Falcons (*Falco peregrinus*) in the midwestern U.S. had greater sur-

vival to breeding than wild-fledged falcons (Tordoff and Redig 1997), presumably because of the greater amount of food available to released birds, food available until they are fully independent (Tordoff et al. 2000). This same factor may have been at work here; our site attendants made sure that food was available twice a day until the young birds had left the area, perhaps resulting in heavier birds with a greater chance of first-year survival.

Another striking feature of this population was the tendency of males to return to the study area to breed, as opposed to the almost total lack of returning females. The greater dispersal distance we found for females ($\bar{x}$ = 384 km) vs. males ($\bar{x}$ = 27 km) has been noted in other Osprey populations (Poole 1989, Postupalsky 1989). These sex-influenced dispersal patterns are also found in other birds (Newton 1979, Greenwood 1980, Restani and Mattox 2000) and may be related to the amount of effort each sex spends on territory competition versus raising young (Greenwood 1980). A differential dispersal pattern has implications for translocation projects, in that releasing males, rather than females, may have a greater impact on establishing a population. However, it can be argued that releasing only males results in a drain of females from donor populations, while this is balanced by exported females if both sexes are released. Also, it may be helpful for young males to have social discourse with young females.

As a long-distance migrant, an individual Osprey's survival depends on its ability to cope with habitats other than the breeding grounds. Thus, it is important that translocated Ospreys develop appropriate migration patterns and find suitable wintering areas. Band returns and satellite telemetry (Martell et al. 2001) indicate that birds from this Twin Cities population use migration routes and wintering areas similar to those used by other Ospreys from the region (Henny and Van Velzen 1972, Poole and Agler 1987, Martell et al. 1998).

The Osprey population in the Twin Cities should continue to grow, limited mostly by available nest sites. As Osprey populations in northern Minnesota and western Wisconsin continue to increase and spread, this new urban population will likely merge with the regional population. The most important management factor will be to maintain existing nesting platforms and continue the appropriate placement of new ones. It is unlikely that urban-forestry practices will allow for the development of enough super-canopy trees or snags for such sites to become a factor in the management of the Twin Cities Osprey population.

ACKNOWLEDGMENTS

Translocation, monitoring, and management involved resources provided by Hennepin Parks, The Raptor Center, and the Bell Museum of Natural History at the University of Minnesota, Carpenter Nature Center, and Minnesota Power. Special thanks to Jim Fitzpatrick, Vanessa Greene, and Matthew Solensky. Monitoring and management of nest sites has been aided by Robert Anderson, Tom Bell, Jim Bracke, Amy Donlin, Larry Gillete, Art Hawkins, Ray Herman, Missy Patty, Doreen Scriven, and Xcel Energy Corporation. Insightful comments and assistance were provided by D. Alstad, L. Kiff, R. Seidl, D Stahlecker, and S. Weisberg.

LITERATURE CITED

CADE, T.J. 2000. Progress in translocation of diurnal raptors. Pages 343–372 *in* R.D. Chancellor and B.-U. Meyburg [EDS.], Raptors at risk. WWGBP/Hancock House, London, U.K.

COFFIN, B. AND L. PFANNMULLER. 1988. Minnesota's endangered flora and fauna. Univ. of Minnesota Press, Minneapolis, MN U.S.A.

GILLETTE, L.N. AND J. VOIGT ENGLUND. 1985. The Hennepin County Park Reserve District's Osprey reintroduction project. *Loon* 57:52–58.

GREENWOOD, P.J. 1980. Mating systems, philopatry, and dispersal in birds and mammals. *Anim. Behav.* 28 1140–1162.

GRIFFITH, B., J.M. SCOTT, J.W. CARPENTER, AND C. REED. 1989. Translocation as a species conservation tool: status and strategy. *Science* 245:477–480.

HAMMER, D.A. AND R.M. HATCHER. 1983. Restoring Osprey populations by hacking preflighted young. Pages 293–297 *in* D.M. Bird, N.R. Seymour, and J.M. Gerrard [EDS.], Biology and management of Bald Eagles and Ospreys. Harpell Press, Ste. Anne de Bellevue, Quebec Canada.

HENNY, C.J. AND W.T. VAN VELZEN. 1972. Migration patterns and wintering localities of American Ospreys. *J Wildl. Manage.* 36:1133–1141.

——— AND H.M. WIGHT. 1969. An endangered Osprey population: estimates of mortality and production. *Auk* 86:188–198.

MARTELL, M. 1995. Osprey (*Pandion haliaetus*) reintroduction in Minnesota, U.S.A. *Vögelwelt* 116:205–207.

———, C.J. HENNY, P.E. NYE, AND M.J. SOLENSKY. 2001. Fall migration routes, timing, and wintering sites of North American Ospreys as determined by satellite telemetry. *Condor* 103:715–724.

———, M.J. KENNEDY, C.J. HENNY, AND P.E. NYE. 1998. Highway to the tropics: using satellite telemetry and the internet to track Ospreys in the western hemisphere. Pages 163–172 *in* Y. Leshem, E. Lachman, and P. Berhold [EDS.], Migrating birds know no boundaries; scientific and educational aspects of migrating

bird conservation, August 31–September 6, 1997 Tel Aviv, Israel. *Torgos,* No. 28 Summer 1998.

———, H.B. TORDOFF, AND P.T. REDIG. 1994. The introduction of three native raptors into the midwestern United States. Pages 465–470 *in* B.-U. Meyburg and R.D. Chancellor [EDS.], Raptor conservation today. Pica Press, East Sussex, U.K.

NEWTON, I. 1979. Population ecology of raptors. Buteo Books, Vermillion, SD U.S.A.

POOLE, A.F. 1989. Ospreys, a natural and unnatural history. Cambridge Univ. Press, Cambridge, U.K.

——— AND B. AGLER. 1987. Recoveries of Ospreys banded in the United States, 1914–1984. *J. Wildl. Manage.* 51:148–155.

POSTUPALSKY, S. 1989. Osprey. Pages 297–313 *in* I. Newton [ED.], Lifetime reproduction in birds. Academic Press, London, U.K.

RESTANI, M. AND W.G. MATTOX. 2000. Natal dispersal of Peregrine Falcons in Greenland. *Auk* 117:500–504.

ROBERTS, T.S. 1932. The birds of Minnesota. Vol. I. Univ. of Minnesota Press, Minneapolis, MN U.S.A.

RYMON, L.M. 1989. The restoration of Ospreys, *Pandion haliaetus,* to breeding in Pennsylvania by hacking (1980–89). Pages 359–362 *in* B-U. Meyburg and R.D Chancellor [EDS.], Raptors in the modern world WWGBP, Berlin, Germany.

SEYMOUR, N.R. AND R.P. BANCROFT. 1983. The status and use of two habitats by Ospreys in northeastern Nova Scotia. Pages 275–281 *in* D.M. Bird, N.R. Seymour, and J.M. Gerrard [EDS.], Biology and management of Bald Eagles. Harpell Press, Ste. Anne de Bellevue, Quebec Canada.

TORDOFF, H.B. AND P.T. REDIG. 1997. Midwest Peregrine Falcon demography, 1982–1995. *J. Raptor Res.* 31:339–346.

———, J.S. CASTRALE, M.S. MARTELL, AND P.T. REDIG 2000. Brood size and survival to breeding in midwestern Peregrine Falcons. *J. Field Ornithol.* 71:691–693.

WESTALL, M.A. 1983. An Osprey population aided by nest structures on Sanibel Island Florida. Pages 287–293 *in* D.M. Bird, N.R. Seymour, and J.M. Gerrard [EDS.], Biology and management of Bald Eagles and Ospreys. Harpell Press, Ste. Anne de Bellevue, Quebec Canada.

Received 20 March 2001; accepted 10 November 2001
Associate Editor: Marco Restani